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The ties that bind: Buyer-supplier relations in the construction industry

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Abstract

This study considers the consequences of Inter Organisational relations at two levels: the *micro* level of the individual, and the *macro* level of the organisation. Merging Transaction Cost Economics with theories on the Social Embeddedness of relations, the paper tackles several hypotheses about problems in buyer–supplier relations. We amend the general hypothesis, as has been put forward by other researchers, that having a common past in combination with an expected common future in business will reduce the likelihood that problems and conflicts occur. Our focus lies on whether this shared past and future can preclude problems better when the organisational relations are at the micro level. Our analyses of survey data from 448 contractor–subcontractor relations from the contractor's perspective in the construction industry reveal mixed support for effects of a shared past or future. We hardly find any of the expected positive effects of a shared past on supplier performance. However, we do find support for the hypothesis that a larger likelihood of future business with the same business partner has a stronger (negative) effect on the occurrence of problems if the expected future business is at the level of individuals (instead of at the level of organisations).

Keywords: Purchasing; Supplier performance; Problems; Social embeddedness; Organisational ties; Game theory; Transaction cost economics

1. Introduction

In many studies on inter-organisational relationships, researchers refer to the so-called *shadow of the past* and/or the *shadow of the future* (e.g. Heide & Miner, 1992; Heide & Stump, 1995; Batenburg et al., 2003). Both are considered part of what is called the *temporal embeddedness of a relationship.* Under the shadow of the past, past experiences with the other party are assumed to play their role in determining the type of behaviour towards that party. The shadow of the future is largely determined by the expected likelihood that partners meet again in the future. The general gist of the argument is that, in case of high temporal embeddedness, opportunistic behaviour is assumed, ceteris paribus, to be less likely. Learning from the partner's behaviour in the past enables more effective and efficient selection and planning, while an expected common future induces control, because of the possibility for the other party to retaliate; 'tit-for-tat' (I will treat you as you treat me).

Although in theoretical experiments temporal embeddedness seems to have a positive impact on cooperation (Axelrod, 1984), many empirical studies found only partial or even a total lack of support for this claim. Elsewhere (Welling & Kamann, 2001, 2003; Kamann and Welling, 2004), we pointed at a possible cause for this lack of support. Most studies look at inter-organisational relations only at the organisational level; that is, they do not check whether indeed Mr *A* of Company *1* is likely to meet Mr *B* of Company *2* again in the future, but only whether Company *1* is likely to do business with Company *2* in the future, irrespective of the identity of the actual individuals involved. We can illustrate the usefulness of distinguishing individual or micro level contacts from

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macro or organisational *level* contacts by looking at the construction industry. In the construction industry, the project leader and/or foreman play a very important role in (a) the supplier selection part of the purchasing process; (b) the day-to-day contacts and progress of the construction project. Especially in cases where the sub-contractor's services are interwoven with the processes of the construction project as a total project, project leaders have an important say in the supplier selection. One of the reasons for this is that in these cases, lack of cooperation at the micro level immediately results in additional project costs. In combination with this, another reason for the distinction is that, as Welling and Kamann (2001) demonstrated, in many industries in which deals are often project based—such as the construction industry—individual actors such as project leaders do not necessarily meet the same person they have done business again, *even in cases where the two companies do collaborate again at an organisational level.* Our hypothesis is that from a theoretical point of view it matters whether we study inter-organisational relations from the level of the individual—the *micro* level—or from the level of the total organisation – the *macro level.* Similarly, other levels in between could be identified, such as the level of Business Units or departments: the meso level. The point is that, necessarily, the more aggregate the level is, the less likely it is that actors have *personal* experiences with their counterparts. The more aggregate the level of interaction, the more important information systems are that store information about the reliability and general compliance of counterparts to expectations and contracts, common in an organisation. These systems might substitute personal memory and represent the organisational memory about third parties and the way they behave. To rely on these systems actually assumes that a third party will behave identically with everybody from the focal organisation we study, irrespective of personal favours or dislikes. In any case, the differences in the levels of aggregation across different studies is a possible explanation as to why some studies find effects of temporal embeddedness on business interaction, whereas others do not.

To deal with this issue from a theoretical point of view, a theoretical framework was developed (Kamann and Welling, 2004), combining the traditional transactional views of Transaction Cost Economics (TCE) with those of Social Embeddedness (cf. Buskens et al., 2003) and drawing from the ideas and studies of the GREMI-Group (Camagni, 1991) and the IMP-School (Axelsson and Easton, 1992). From this framework—to be summarised hereafter—a number of hypotheses are derived, with respect to the role of the temporal embeddedness, especially on combination with personal network relational embeddedness. Hence, our main question is whether the shadow of the past and the shadow of the future "work better" (in the sense that they prevent problems in buyer–supplier relations) when the inter-organisational relations are based on individuals instead of organisations.

We first discuss the theoretical framework employed: (1) the transaction cost economics and (2) the role of social embeddedness. The hypotheses are then formulated, where the centre of our attention is on the effects of the shadow of the past and the shadow of the future. Our base-line hypothesis is that a shared (positive) past and expected future business will decrease the eventual number and severity of problems in buyer–supplier relations. The next section describes the data set we used to test our hypotheses. The data consist of 448 contractor–subcontractor transactions in the Dutch construction industry. The conclusions and recommendations follow after the results of the analysis, employing both ordinary least squares estimation and 3-stage least squares.

2. Theory: transaction cost economics and social embeddedness

In Transaction Cost Economics (TCE), following Commons (1934), the (purchasing) transaction is the basic unit of analysis (Williamson, 1975). An economic governance structure is according to Williamson (1981, p. 1544) the explicit or implicit *contractual framework* within which a transaction is located. The original definition of transaction costs—'costs of running the economic system' (Arrow, 1969, p. 48)—could then be reformulated following Macneil (1981, p. 62) as 'costs of running the contractual relation'. In principle, only four possible economic governance structures—types of contracts—are available for a single transaction or a series of purchasing transactions. Which governance situation is suitable, depends on the size of the transaction costs given certain transaction characteristics.

We are aware that when TCE describes various governance structures, it uses in line with its neo-classical pedigree, the following two assumptions about human behaviour: people behave in accordance with bounded rationality and are guided by their own inclinations for opportunistic behaviour and the anticipation of opportunistic behaviour by other actors involved in the transaction. For the rest, the criterion for organising transactions is assumed to be the strictly instrumental one of cost and risk minimising or revenue optimising. In this light, we say that economic phenomena originating from the economic structure like decreasing margins, falling profits and market shares, new entrants, new innovations by competitors, or tightening shareholder's demands increases the drive to 'cheat', 'manoeuvre' or show opportunistic behaviour. At the same time, the various contract forms have to regulate this properly by arranging for effective deterrents.

An economic analysis such as in TCE neglects the identity and role of past relations—*'shadow of the past'*—of individual transactions. The existence of personal relations in all real-life transactions and the widespread preference for transacting with individuals of known reputation and successful prior experiences raises serious problems for a

TCE analysis and limits its accuracy. In addition to the main economic—*contractual*—governance structures, a richer apparatus of classification is needed, that includes the way in which persons relate to each other—the *contact* patterns or 'social governance'.

An answer to these problems comes from sociology. As mentioned by Rooks et al. (2005), classical sociology (Durkheim, 1893: Book I, Chapter 7; Weber, 1921: 409), the sociology of law (see Macaulay's seminal 1963 study and the "law and society" approach building on Macaulay's work), and more recently the new economic sociology (see Smelser and Swedberg, 1994 for a representative overview) have provided arguments that can be used to generate hypotheses on how problems and performance in transactions depend on embeddedness. Integrating transaction cost economics and sociology, 'contracts' and 'contacts' can be seen as two different roles from the perspective of framing theory (Lindenberg, 1993) or—from a dialectic perspective—as opposite forces with *'organisation man'* as the synthesis: the *'socio-economic'* governance structure.

Applying this to purchasing transactions, we assume that next to the 'contract', purchasing transactions in real life are embedded in relations of different contents: they are socially embedded (Macaulay, 1963; Ouchi, 1980). Macaulay (1963) refers to this as the *'non-contractual* relations *in business'*. This social embeddedness also creates a certain degree of protection and control over the purchasing transaction process. For, social relations between actors influence the process of purchasing transactions and vice versa. Social embeddedness can be seen as an addition to—or even as a substitute for—the contract. The actions of the organisational actors are interdependent, and, these actors take on specialised roles and develop behavioural expectations of each other over time (Van de Ven, 1976). Once purchasing relationships are established, patterns of interaction are likely to persist given that this persistence of interaction patterns reduces uncertainty for the actors involved (Pfeffer and Salancik, 1978). In this context it is not surprising that Granovetter (1985: p. 504) suggests a careful and systematic attention to the actual patterns of interpersonal relations that are present in transactions. As stated elsewhere (Kamann and Welling, 2004), this implies that proper functioning of actors at a *micro* level depends on a proper set of contacts—embedded in relations and activities—both within organisations and outside; both work related and non-work related. Proper functioning of the organisation depends on proper relations viewed as (1) a collection of all contact patterns of the individual members of the organisation; (2) all institutionalised relations with outside actors, the organisation has.[1] Paying attention to contact patterns will also enable us to comprehend the various complex intermediate forms between idealised atomic markets and completely integrated firms. An example is the *'quasi-firm'* for the construction industry as described by Eccles (1981) and Constantino and Pietroforte (2001).

Summarising a lengthy discussion on the processes of conditioning, matching, mental map and goal congruencies, contagion and selection (cf. Kamann, 1994, 1995, 1999; Kamann and Bakker, 2004), we argue that a shared past strengthens the personal relationship between the so-called organisational boundary spanners. Attitudes, values, and goals get more similar and mutual 'trust'[2] in one another increases. As a result, a shared past positively affects partners' predisposition to help one another out by committing their organisations to a purchasing relationship, while refraining from opportunistic behaviour (Van de Ven, 1976). 'Time' seems to be a vital incubator precondition for growing 'trust' and 'goal congruence'; two key elements in creating cooperative behaviour (cf. Ford, 2002). For that reason, we incorporate the temporal embeddedness of contacts into our frame of reference (cf. Heide and Miner, 1992; Noordewier et al, 1990): we use the term *'shadow of the past'* to reflect the existence of a common past, *the shadow of the future* refers to the likelihood that actors meet again in the future. Using the term shadow of the past, we assumed—as was supported by 28 interviews with project managers—that purchasing organisations (or individuals) have strong preferences for doing business with partners that they have certain prior experiences. This assumption is theoretically based on Van de Ven (1976) who stated that, over time, successful purchasing relationships tend to become meshed together in a web of interdependencies.

One way to understand why a shadow of the future might be beneficial is that for a 'tit-for-tat' strategy to work there must be a large enough probability that there actually is a next round to sanction a present 'tat' with a future 'tit'. Opportunistic behaviour becomes tempting and attractive in the case of spot market exchange. In general, we argue that cooperative behaviour in buyer–supplier relations is more likely, the more likely it is that business partners will meet in the future (Axelrod, 1984; Batenburg et al., 2003). In social life, individuals are likely to meet people they interact with in the future. This means that the shadow of the future is a normal part of social relations among members of a social group. However, in organisations, a different situation occurs. It is no longer clear whether the benefits of having past and likely recurrent interaction relate to relations between individuals or to relations

[1] We refer to institutional actors in the selection environment , task environment or any of what might be called "STEPE actors" (Johnson and Scholes, 1984/2002; Kamann, 1988/2003): trade unions, stakeholders but also suppliers who have a long term contract but where the acting purchasing officer in charge has been replaced as a result of job rotation. In the case of STEPE actors, there *may* be a shadow of the past at the individual level; in the case of job rotation, there is no 'shadow of the past' at the individual level. In both cases, there is a shadow of the past at the organisational level.

[2] 'Trust' is used here in its meaning of 'lack of opportunism', 'good faith', or 'willingness to share more strategic information' (cf. Kamann, 1988/2003).

between organisations. As stated in our introduction, we separate these two levels of aggregation: the *micro* level of the individual project manager and/or purchasing manager and the *macro* level of the organisation.[3]

It should be noted that transaction cost theory *as such* does not focus on explaining performance. Rather, TCE asks how transaction characteristics affect the ''governance'' of a transaction. Roughly, the idea is that the characteristics of a transaction—one usually distinguishes asset specificity, uncertainty and estimated frequency of the transaction in future—affect the risks associated with a transaction. These risks then determine the way in which a transaction will be (or should be) governed. Hence, ''governance'' refers to the measures actors involved in an exchange use or implement in order to mitigate risks and therefore also to improve performance. Transaction cost theory thus tries to explain ex ante governance and, specifically, contractual features of governance (such as which kinds of contract are used), under the assumption that the governance of a transaction is subject to economising behaviour of exchange partners. Similar to Rooks et al. (2005), we assume that transaction characteristics affect performance directly through incentive effects for suppliers as well as indirectly through contractual governance that anticipates on performance effects. Since contractual governance is costly, economizing on contractual ex ante governance will typically not eliminate all risks associated with the transaction so that problems and less than optimal supplier performance are likely to occur.

In general the probability of cooperation problems to actually occur is determined by (1) the potential to behave opportunistically (in some cases there is more room to misbehave than in others); (2) the economic *need* to behave opportunistically (under some conditions, any firm or person is more likely to misbehave) and (3) by the general *personal propensity* to behave opportunistically (some firms or people are by 'nature' more inclined to misbehave). We acknowledge that a focus on the individual level brings us dangerously close to a detailed analysis on individual differences with respect to opportunistic behaviour, whereas one would in general prefer to be reluctant to include explanations in a business context that delve too deeply into the psychological particularities of each and every individual. The focus of our analysis, however, is solely on the effects of temporal embeddedness on cooperation problems between buyer–supplier relationships.

3. Hypotheses

As our dependent variable we consider the amount and degree of problems that occur in buyer–supplier relationships. Problem in the sense of ''anything that delayed the construction project, increased costs or otherwise was not foreseen and experienced as normal business behaviour as to be expected''. TCE offers many independent variables that could have an effect on the amount and degree of experienced problems. In our empirical analysis we will indeed control for several characteristics of the product or service, characteristics of the buyer, the supplier, and of the context in which they operate. However, our centre of attention in this paper is the effect of the shadow of the past and the shadow of the future. The base-line hypothesis is that a shared (positive) past and expected future business decreases the problems in buyer–supplier relations.

Basic hypothesis [*shadow of the past*]: In buyer–supplier relations where buyer and supplier have conducted business before, less problems will emerge in the focal transaction.

Basic hypothesis [*shadow of the future*]: The more buyer and supplier expect to conduct future business with each other, the less problems will emerge in the focal transaction.

However, usually this hypothesis is theoretically argued and tested (e.g. Gulati, 1995) on the level of organisations. As outlined above, we hypothesize that this effect will hold stronger if one would consider the shared past and expected future for individuals instead of the organisations they represent.

Extension of the basic hypothesis [*shadow of the past*]: In buyer–supplier relations where buyer and supplier have done business before *on the individual level*, even less problems will emerge as compared to when buyer and supplier have done business before *on the organisational level*.

Extension of the basic hypothesis [*shadow of the future*]: The more buyer and supplier expect to do business with each other *on the individual level*, the less problems will emerge. This effect is stronger than in the case where buyer and supplier expect future business *on the organisational level*.

4. Data

As our sampling frame we decided to focus on the Dutch construction industry, for a combination of reasons. First, the construction industry is characterised by short-term inter-organisational relations between partners in construction (contractors, subcontractors, architects, etc). This poses high demands on mutual communication and coordination (Voordijk, 1994, p. 88). If we look at construction projects more closely, we see that these relations between organisations usually come about by a series of (hierarchical) bilateral agreements and subcontracts (Jacobs et al., 1992). With bilateral agreements we mean that partners in construction make separate agreements with the main contractor, without much

[3]One could argue about whether the term macro level should be reserved for the level of the sector, as is customary in industrial organisation (cf. Kamann, 1988/2003).

mutual influence (Voordijk, 1994). This does not imply that the different construction partners do not depend on each other. On the contrary, one of the consequences is that construction partners are "sentenced by the main contract" to work together in the construction process (Jacobs et al., 1992, p. 96 and further).

Although the nature of the business is project-like, long-term relations between organisations can arise. Not because of official partnerships, but because of the fact that firms in future projects will meet again, and know that they will need similar business partners. This is what Eccles (1981) called *the quasi-firm in the construction industry*. As Constantino and Pietroforte (2001) reconfirm, the construction process can be concerned to be a typical "network industry".

Although usually organisations are considered to be separate entities ("corporate actors"), we want to focus explicitly on the relations between the individuals. According to research by the Dutch EIB (2004, p.12; Economic Institute for the Construction Industry, in Dutch: Economisch Instituut voor de Bouwnijverheid), only 15% of the individuals working in construction never cooperate with individuals from other organisations. On the other hand, it seems that the frequency with which individuals work together with individuals from other organisations could be rather low (Geerink, 1998, p. 60).

These facts, together with the heated debate in (not only Dutch) construction about cooperation problems and opportunistic behaviour, make the construction industry an interesting test ground for our hypotheses. Individuals and their firms are connected in a network of (sometimes short-term) cooperative relations, and the project-like structure of cooperation puts high demands on coordination, communication, and gives ample opportunities for opportunistic behaviour.

We decide to use a questionnaire to be able to test our hypotheses for their validity across the industry. As the basis for the questionnaire, we used the MAT98 data collection (see Buskens and Batenburg, 2000), a survey specifically geared at cooperative relations in the IT-industry, but easily adaptable for our purpose. This MAT data set has been used to test hypotheses on how transaction characteristics, embeddedness and contracting affect supplier performance in transactions between buyers—all small and medium sized enterprises (SMEs) and IT-suppliers (cf. Rooks, 2002; Rooks et al., 2005). An English version of this questionnaire is available (Buskens and Batenburg, 2000).

The questionnaire was divided into seven parts, roughly following a contractor–subcontractor transaction chronologically:

1. what kind of purchasing transaction was this (questions on the characteristics of the transaction,
2. the choice of subcontractor (questions on search and selection of the subcontractor),
3. the relationship with the chosen subcontractor (question on, among others, the temporal embeddedness of the contractor–subcontractor dyad)
4. the agreement with the subcontractor (questions on kind and content of the agreement, the degree of detail in the agreement, etc.),
5. the result of the transaction (question on kind and severity of problems encountered)
6. the transaction as part of a larger project (question on the position of the transaction in a larger construction project), and
7. the respondent (questions on the respondent him/herself, the company they work for, etc.).

For a transaction to be appropriate for subsequent questioning, it had to fulfil the following three requirements:

1. the transaction had to be recently completed (so that we could assess the kind and degree of problems in full),
2. the respondent should be aware of all ins and outs of the purchasing transaction, and
3. the value of the purchasing transaction should exceed 5000 Euro.

Ten different experts in the field of construction, all with experience in purchasing in construction and contractor–subcontractor relations in construction, commented on the first version of the questionnaire. Moreover, experts from the Dutch Economic Institute for the Construction Industry (EIB: Economisch Instituut voor de Bouwnijverheid), an institute that has years of experience in designing and running surveys in the construction industry, also commented on the questionnaire. Filling out a questionnaire took about 30 min on average. The questionnaire was considered to be "clear" and "certainly to the point". Some changes were made in language and wording to make some questions fit the "construction industry language" better. Our questionnaire on transactions between contractors and subcontractors in the construction industry is available as a PDF document (in Dutch); an English codebook is being prepared and available on request. As much as possible, we used questions that ask for objective facts ("Have you done business before with this company?," "Was a written contract used?," "Who [largely] designed the contract?," "Which of the following problems did you encounter in this transaction?," etc.).

We collected data about 448 contractor–subcontractor relations. Contractors were contacted by telephone and invited to participate in an online survey on "cooperation between contractor and subcontractors in the construction industry". No specific reference was made as to what the precise topic of the survey was. Participation was voluntary, no specific rewards were promised or given other than that we offered a summary of the results to those who were interested. The telephone numbers were taken from the Chamber of Industry and Commerce database—2004, and we stratified our sample with respect to a) the type of construction project ["GWW vs. B&U": in Dutch "Grond- Weg en Waterbouw," which are typically

Table 1
Overview of the complete sample data ($N = 448$)

	Firm size (contractor)			
	Small <20	Medium (20–100)	Large (>100)	Unknown
Infrastructural works[a]	55	52	42	1
Housing, Offices and Factories[b]	122	83	69	1
Other	4	10	5	4
Total: 448	181	145	116	6

[a]In Dutch: GWW-sector (Grond Weg & Waterbouw).
[b]In Dutch: B&U: (Burgerlijke en Utiliteitsbouw).

governmental projects, and "Burgerlijke en Utiliteitsbouw," which are typically private projects] and b) the contractor's firm size [less than 20, 20–100, more than 100]. In total, 3612 phone calls were made with contractors in the construction industry with an online (e-mail) connection. From these 3612 contractors, 1984 declared to be willing to participate (55%). These subjects were sent an invitation to fill out an online questionnaire. From these invitations $N = 448$ completed questionnaires were received (23%). Table 1 gives an overview of our sample. The median value of a transaction in our data is 29,000 Euro.

5. Results

As our dependent variable, we consider the amount and degree of problems that the contractor and subcontractor were confronted with. After extensive consultation with experts in the field, we developed a survey that asked whether 23 potential problems had occurred (and whether they could in principal occur for this transaction), ranging from discussion about on time delivery, not meeting the agreed specifications, discussion about tidiness on the work site, and about not supplying the paper work on time. For all these items, we asked for answers on a 5-point Likert scale (1 = problem did not occur, 2 = was a minor issue, 3 = was somewhat of a problem, 4 = was a problem, 5 = was a big problem) and also gave respondents the opportunity to indicate that the potential problem was simply inappropriate given the transaction. We coded this as a zero (since, given that the problem was inappropriate for that particular transaction, it obviously did not arise). There are then several ways in which one can measure the "total amount" of problems. We consider three. First, we dichotomised all items and count any item with a score of 3 or more as a problem, and then add all items to get the total number of problems encountered. Second, we recoded all zeroes to ones, and then averaged the score across all items. Third, for each case, we counted the number of problem items that the respondent deemed appropriate for that particular transaction. We then know that the maximum "amount" of problems one could experience is that number times 5, the maximum on the scale. We

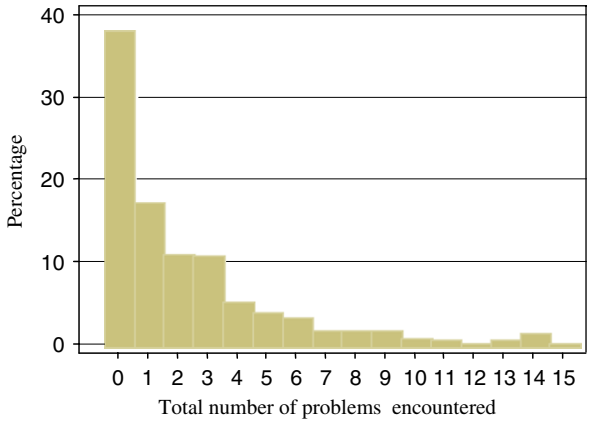

Fig. 1. Total number of problems encountered in contractor-subcontractor cooperations ($N = 448$). In 38% of the cases, no problems were encountered. The maximum number of problems encountered was 15.

subsequently calculated the total score for the appropriate problems and divided this by the maximum amount, to get a percentage score: the percentage of problems that has materialised, taking into account that not all problems in the list of 23 possible problems *can* materialise. To get a feel for the data, we show in Fig. 1 the number of problems that were encountered using the first way of measurement: a simple count of the total number of problems. In 38% of the cases, no problems of a substantial matter were encountered. The worst case in our data is a case where problems were experienced on all 15 different dimensions.

The three different ways to measure the problems experienced show relatively strong correlations (the lowest is 0.73 between the second and third measure), and in any case our results do not depend on the choice of dependent variable. We report our subsequent analyses based on all three measurements.

Table 2 shows an overview of the kinds of problems that were most prevalent in our data. It appears that preciseness and tidiness of the work is mentioned most often, together with discussions about the price for extra work (or the discount for less work), when the work should start and be finished, and the delivery time.

Although our main emphasis is on the effects of temporal embeddedness of relations between organisations and individuals, in all analyses we control for a number of other, possibly relevant variables that might intervene with our results. Here we do not go into the details of these variables; most are based on standard arguments from transaction cost theory. We control for variables such as the (natural log of) the price of the product or service, the price relative to the total project price, the experience with the subcontracting of similar products or services, how many other suppliers were available (if any), whether the subcontracting concerned a product delivery or a service, and the investment in transaction management (see the tables with the analyses for the complete list of included variables).

Table 2
Overview of the percentage of contractor–subcontractor transactions that experienced a particular problem ($N = 448$)

Average percent time Problem occurred (%)	Type of problem occurred:
23.6	Discussion about preciseness and tidiness of the work
21.6	Discussion about price of extra/less work
21.2	Discussion about when work should start and finish
17.8	Discussion about delivery time
15.8	Tender not as agreed upon
14.9	Discussion about completeness of tender
12.9	Discussion about sending enough employees to the work site
11.1	Discussion about quality, Arbo, or safety and environmental issues
10.0	Discussion about quantities delivered/used
9.8	Discussion about cleaning up the construction site
9.3	Discussion about changing personnel on work site
9.1	Construction plans late or wrong
8.9	Discussion about payment or payment scheme
8.9	Discussion about dealing with complaints after final payment
8.2	Discussion about general agreement scheme (''Algemene voorwaarden'')
5.3	Discussion about the use of tools and machinery
5.3	Discussion about warranties and/or maintenance
4.4	Discussion about late or inaccurate delivery of ''wka'' data etc
3.5	Discussion about subcontracting or ''ZZP''-employees
2.0	Discussion about using foreign employees
2.0	Discussion about taking care of a warranty of the bank (''bankgarantie'')
1.7	Subcontractor worked on the basis of wrong design plans
1.5	Subcontractor went broke

The fact that we are looking at problems as our dependent variable and control in our analysis for the investment in management necessitates a specific statistical strategy. What we are interested in is the 'net' effect of investments in purchasing management on the amount and degree of problems, while taking into account the fact that management itself is also determined by characteristics of the transaction, the contractor, the subcontractor, etc. This poses a methodological problem: one of the predictors of the amount and degree of problems is itself endogenously determined, and this implies that employing standard regression techniques is not likely to deliver valid inferences.[4] However, such models can be adequately estimated using different variants of ''instrumental variable regression'' (including 2-Stage-Least-Squares and 3-Stage-Least-Squares, Zellner and Theil, 1962; Johnston and Dinardo, 1997; Davidson and MacKinnon, 1993). We control for transaction characteristics (complexity of product, hardware vs. software, whether there were any monitoring problems for the buyer, the switching costs involved, etc), and buyer and supplier characteristics (size and reputation of the supplier, whether buyer and supplier had done business before, degree of dependency on the supplier, etc.). Fig. 2 summarizes this view on the way in which characteristics of the transaction affect the amount and degree of problems both directly and indirectly through investments in transaction management.

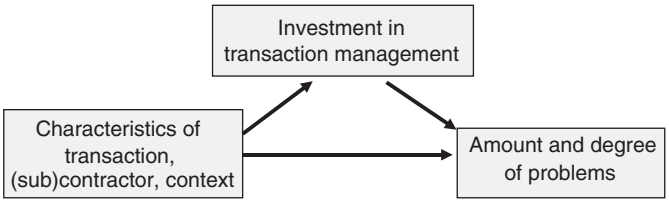

Fig. 2. Schematic overview of how investments in transaction management are endogenous in explaining the amount and degree of problems.

An important finding in our data is that a written contract is only used in 75% of the cases. The other 25% of the cases are not governed by any written agreement (at least not between the contractor and the subcontractor). Closer inspection of the data show that this happens precisely in those cases where it is to be expected: it happens more often in those cases where contractor and subcontractor are organisations of a smaller size (typically less than 5 employees), when on-time delivery is not so much of an issue, when it considers a delivery (as opposed to a service) and monitoring problems are not very severe. We will run our analyses on the effects of temporal embeddedness separately for the cases with and without contract.[5]

Our variables measuring the shared past (and future) are split in two. First, we define a dummy-variable that is equal to one if either [1] the two individuals (one from the contractor and the key-contact at the subcontractor) have conducted business before *or* [2] the individual from the contractor has conducted business with the subcontractor organisation before. Second, we define a dummy that is equal to one if the contractor and subcontractor organisation have conducted business before, but the individual at

[4]For triangular models such as this one, we could use standard regression techniques only when the residuals in the estimation equation for the investment in management are not related to the residuals in the estimation equation of the amount and degree of problems. Tests show that in this case this assumption is in fact violated, but only for the cases in which a written contract was used, not for the cases where all matters were arranged orally.

[5]Actually, since whether or not a contract is used is an endogenous decision, it would be better to model it as a separate decision and take this into account in the data analysis. Given the complications of such an analysis, we will not do this here. It would therefore be more accurate to state that we analyze the effects of temporal embeddedness on the amount and degree of problems, *given* that contractor and subcontractor have chosen whether or not to use a written contract.

Table 3
Cross-tabs of the existence of an individual past and an organisational (but not individual) past, separate for transactions arranged with and without a written contract

Written contract				Written contract			
		No	Yes			No	Yes
Ind. Past	No	22	92	Strictly org. past	No	99	317
	Yes	83	246		Yes	6	21
Ind. Future	No	20	71	Strictly org. future	No	103	319
	Yes	85	267		Yes	2	19

the contractor has not conducted business before with the sub-contractor organisation. The same applies for the definition of a shared future. Table 3 shows cross-tabs of these variables for cases with and without a written contract.

It appears that it might be difficult to find results, even if they are present in the data and the population, given the above. To test our extended hypotheses, our statistical power has to come from the cases where a shared organisational past or future exists, but not an individual past or future. There are, however, comparatively little cases in our data that have a strict organisational past or future (27 for past, 21 for future, about 5% of the cases). It turns out that business contacts in the construction industry is indeed a "network industry" in the sense mentioned in our introduction and theoretical section, but it is even a bit more of a individual network industry than we had hoped for our analytical purposes. With that in mind, we now turn to our analyses.

Tables 4(a) and (b) show the results of our analyses explaining the amount and degree of problems. We present results separately for the cases where a written contract was used and for the cases where a written contract was not used.

Table 4(a) shows the results of three three-stage least squares analyses for the cases where a written contract was used; one for every operationalisation of the dependent problems-variable. Since in three-stage least squares we do not only try to predict the dependent variable (problems) from independent variables, but simultaneously try to predict the endogenous independent variable (investment in contracting), each analysis covers two columns of the table (one column for problems, one for contracting). Our emphasis is on the columns with the different measures for problems as the dependent variable. We find, among others, that larger investments in contracting go together with less problems. Problems increase with the price of the product or service, and product deliveries are less problematic than services.

The effects of temporal embeddedness are strange when it comes to a shared past. None of these effects are significant and in any case in an unexpected direction: relations with a past experience (non-significantly) more problems. This clearly not only contradicts our basic hypothesis, but also does not give support to our extended hypothesis. The effects of the shadow of the future are in the right direction. One should recall here that the number of cases we have available for these variables is small, but we still find a borderline significant effect ($p = 0.052$, 2-sided) for the shadow of an *individual* future. The effect of the shadow of the organisational future is smaller and in fact not significantly different from zero. Given the small number it is not surprising that the difference between the organisational and individual shared future is not significant ($p = 0.32$). Nevertheless, here we indeed see a case where if we would consider an organisational past only, we would likely not find an effect of the shadow of the future, whereas we do if one considers the individual shared future.

Table 4(b) shows the results for an ordinary least squares analyses for the cases where no written contract was used. In this case, closer inspection of the data revealed that the endogeneity problem that called for three-stage least squares analysis in Table 4(a), was not that severe. In Table 4(b) we again show analyses for all three operationalisations of the problem-variable, and present an additional analysis that includes several control variables.

Once again the findings for the shared past are the most puzzling. We now *do* find the expected negative effect of a shared past on purchasing for two of the three operationalisations. However, across all but one of the analyses, the effect of the organisational past is stronger than that of the individual past. The effects of the shared future are roughly similar to the results for the cases with the written contracts. Since the number of cases is even smaller, we do not find significant effects, which is to be expected, but effect sizes are similar. The effect of a shared individual future is stronger in all but one analysis than that of the organisational shared future.

Getting back to our hypotheses, our data show that we do not find much support for effects of a shared past. All in all, both the basic and the extended hypothesis on having a shared past is not supported by the data. However, we do find evidence for the fact that a shared individual future is a more important predictor for problems in the cooperation between contractor and subcontractor, than the shared organisational future.

6. Conclusion and discussion

We set out by stating—as others have done—that it would make sense to combine the strict economic interpretation of transaction cost economics with elements that introduce a relational character to cooperation between business partners. Our main focus was on the effects of temporal embeddedness: the effects of business partners having a shared past and/or expecting a shared future. Whereas most researchers have left the level of analysis for the temporal embeddedness largely implicit, we tried to

Table 4
Results of the least squares estimation

(a) 3stage least squares estimation of amount and degree of problems for the cases with a written contract, with the investment in contracting instrumented; $N = 338$ (significance levels in parentheses).

	Problems: average score	Investment in contracting	Problems: percentage score	Investment in contracting	Problems: simple count	Investment in contracting
Specificity of the contract	**−0.384*** (0.047)	—	**−0.609**∼ (0.052)	—	**−3.210**∼ (0.054)	—
(log of) price	**0.086**** (0.001)	**0.063*** (0.019)	**0.118**** (0.003)	**0.062*** (0.021)	**0.651**** (0.002)	**0.063*** (0.019)
Price as a percentage of total project price	**−0.002**∼ (0.072)	−0.002 (0.247)	**−0.004**∼ (0.063)	−0.002 (0.253)	−0.013 (0.207)	−0.002 (0.234)
Experience in dealing with similar products or services	−0.015 (0.527)	0.024 (0.492)	−0.014 (0.717)	0.024 (0.497)	0.178 (0.377)	0.025 (0.489)
Being on time is important	0.037 (0.319)	0.052 (0.340)	−0.016 (0.791)	0.053 (0.330)	0.460 (0.151)	0.051 (0.349)
There was no choice of sub-contractor	−0.017 (0.873)	0.030 (0.861)	0.153 (0.385)	0.035 (0.836)	−0.686 (0.462)	0.034 (0.842)
Number of potential alternative sub-contractors	0.005 (0.948)	0.009 (0.940)	0.095 (0.460)	0.019 (0.877)	−0.620 (0.361)	0.010 (0.934)
This was a product delivery (vs a service)	**−0.250**** (0.000)	**−0.196*** (0.014)	−0.126 (0.187)	**−0.198*** (0.013)	**−1.760**** (0.000)	**−0.200*** (0.012)
Contractor and subcontractor have a shared *individual* past	0.047 (0.466)	0.098 (0.315)	**0.194**∼ (0.061)	0.098 (0.317)	0.523 (0.342)	0.097 (0.322)
Contractor and subcontractor have shared *organisational* past, but not an individual past	0.146 (0.180)	0.024 (0.890)	0.180 (0.309)	0.029 (0.868)	1.131 (0.229)	0.025 (0.886)
Contractor and subcontractor expect to have future business on an individual basis	**−0.148**∼ (0.052)	0.081 (0.478)	**−0.261*** (0.034)	0.080 (0.486)	−1.159∼ **(0.077)**	0.080 (0.484)
Contractor and subcontractor expect that their firms will do future business, but contractor individually will not.	−0.072 (0.608)	0.347 (0.059)	−0.150 (0.507)	0.341 (0.064)	−0.513 (0.670)	0.344 (0.061)
Size of contractor firm (<20,20-100, >100)	—	**0.146**** (0.005)	—	**0.155**** (0.003)	—	**0.140**** (0.008)
Size of subcontractor firm (<20,20–100, >100)	—	0.082 (0.120)	—	0.086 (0.103)	—	**0.091**∼ (0.091)
Price is below market price (dummy)	—	0.049 (0.475)	—	0.019 (0.778)	—	0.053 (0.449)
Constant	2.062** (0.000)	2.585** (0.000)	3.012** (0.000)	2.574** (0.000)	8.226 (0.062)	2.586** (0.000)
Observations	284	284	283	283	284	284

(b) Ordinary least squares estimation (3stage least squares was not necessary in this case) of amount and degree of problems for the cases without a written contract (total $N = 105$; significance levels in parentheses).

	Problems defined as: average score		Problems defined as: percentage score		Problems defined as: simple count	
	Time-invested excluded	Time-invested included	Time-invested excluded	Time-invested included	Time-invested excluded	Time-invested included
(Log of) price	**0.061**** (0.001)	**0.071*** (0.019)	0.036 (0.357)	**0.103*** (0.025)	**0.566**** **(0.001)**	**0.610*** (0.044)
Price as a part of total project price	**−0.002*** (0.045)	**−0.003**∼ (0.059)	−0.001 (0.781)	**−0.005*** (0.029)	−0.010 (0.241)	−0.015 (0.256)
Experience in dealing with similar products or services	0.032 (0.207)	0.051 (0.149)	0.002 (0.967)	0.077 (0.157)	0.173 (0.463)	0.362 (0.307)
Being on time is important	**0.087*** (0.020)	**0.083**∼ (0.064)	**0.215*** (0.011)	0.086 (0.205)	0.530 (0.118)	0.439 (0.324)
There was no choice of sub-contractor	0.121 (0.255)	0.147 (0.320)	−0.027 (0.911)	**0.422**∼ (0.070)	0.885 (0.364)	1.113 (0.457)
Number of potential alternative sub-contractors	0.127 (0.137)	0.084 (0.438)	0.097 (0.616)	0.264 (0.131)	1.180 (0.132)	0.923 (0.400)
This was a product delivery (versus a service)	**−0.108**∼ (0.056)	−0.052 (0.484)	−0.157 (0.213)	0.037 (0.752)	−0.502 (0.328)	−0.203 (0.788)
Contractor and subcontractor have a shared *individual* past	−0.092 (0.308)	−0.146 (0.271)	0.046 (0.813)	0.094 (0.638)	**−1.384**∼ (0.096)	−1.773 (0.187)
Contractor and subcontractor have shared *organisational* past, but not an individual past	**−0.252**∼ (0.060)	**−0.368*** (0.040)	−0.272 (0.347)	−0.266 (0.316)	**−3.240**** (0.009)	**−3.882*** (0.033)
Contractor and subcontractor expect to have future business on an individual basis	−0.079 (0.351)	−0.071 (0.554)	−0.245 (0.189)	**−0.309**∼ (0.094)	−0.894 (0.251)	−1.324 (0.279)
Contractor and subcontractor expect that their firms will do future business, but contractor individually will not.	0.027 (0.888)	0.079 (0.736)	−0.107 (0.795)	−0.042 (0.906)	0.127 (0.942)	−0.034 (0.988)
Number of person-days invested in transaction management	—	0.007 (0.747)	—	0.004 (0.901)	—	0.077 (0.732)
Constant	0.373 (0.093)	0.296 (0.452)	0.553 (0.266)	−0.142 (0.815)	−5.003* (0.015)	−4.960 (0.216)
Observations	81	56	76	53	81	56
R-squared	0.445	0.522	0.186	0.437	0.397	0.426

Dependent Variable: Problems Endogenous Independent Variable: Investment in contracting
Separate analyses for the three problem measures. Significant effects are given in boldface
p-values in parentheses
∼sign. at 5% 1-sided, * sign. at 5% 2-sided; ** sign. at 1% 2-sided

disentangle effects of an *individual* shared past and future from those of an *organisational* shared past and future.

Our data, business transactions between contractors and subcontractors sampled from the Dutch construction industry, showed some interesting findings. First, it makes sense to distinguish between cases that are governed by a written contract, versus those that are governed by oral agreement only. We indeed find that, at least for the smaller and more unproblematic transactions, oral agreements are used (and relatively successful). Our findings do not support an effect of a shared past, individual or organisational, on the probability of problems in the transaction. Only for the cases where no written contract was used, there is some support for an effect of an organisational past.

However, our results may indeed shed some light on the mixed findings in the literature concerning the alleged effect of a shared future. We find that although an expected shared *organisational* future has only marginal effects (if any) on the probability of problems in the present transaction, an expected shared *individual* future does show a small but significant impact on the likelihood of problems. This finding is robust across operationalisations. Future research should make clear precisely when this difference matters and how much, but this study is a first and successful attempt to show that it can make a difference if relational embeddedness is defined at the organisational or the individual level.

Several weak points of our study need to be emphasised here. First, we only collected data through the contractor, not through the subcontractor, which may have an impact on our results. Second, our sampling frame is not really clear. We asked respondents to choose a transaction that had recently been completed, and with which they were well acquainted. It is therefore not really clear what the sampling population is, and one should take this into account when interpreting the results. Third, although the (to us somewhat surprising) finding that a relatively large part of the smaller and unproblematic transactions are not governed by contracts at all, is interesting in itself, it does suggest that one could improve both the theoretical and empirical modelling by explicitly incorporating the decision to use or not use a contract in the decision process.

7. Implications for practitioners

The main practical implication for practitioners lies in the emphasis on possible other ways, relational ways, to safeguard cooperation between business partners. Whereas it might be tempting to safeguard a transaction solely by "economic means," such as through elaborate contracts and planning, it is worthwhile to explicitly take the relationship with the business partner into account. A mutual expectation of future business is a useful asset in the sense that it is less likely that partners will behave opportunistically or perform badly, and can be seen as a complementary and relatively cheap way to make sure that business runs smoothly. Our results suggest that fixed and stable individual contacts with the supplier firm limit coordination and transaction costs and enhance long-run supplier performance, thereby reducing the likelihood of annoying and costly problems on a day to day basis.

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